S.NO	Author Name	Topic	Year	Content
1	Chia-Yen Chiang	Deep Learning-Based Automated Forest Health Diagnosis From Aerial Images	28 Jul 2020	Global climate change has had a drastic impact on our environment. Previous study showed that pest disaster occured from global climate change may cause a tremendous number of trees died and they inevitably became a factor of forest fire. An important portent of the forest fire is the condition of forests. Aerial image-based forest analysis can give an early detection of dead trees and living trees. In this paper, we applied a synthetic method to enlarge imagery dataset and present a new framework for automated dead tree detection from aerial images using a re-trained Mask RCNN (Mask Region-based Convolutional Neural Network) approach, with a transfer learning scheme. We apply our framework to our aerial imagery datasets,and compare eight fine-tuned models. The mean average precision score (mAP) for the best of these models reaches 54%. Following the automated detection, we are able to automatically produce and calculate number of dead tree masks to label the dead trees in an image, as an indicator of forest health that could be linked to the causal analysis of environmental changes and the predictive likelihood of forest fire.

2	Osama M. Bushnaq	The Role of UAV-IoT Networks in Future Wildfire Detection	05 May 2021	The challenge of wildfire management and detection is recently gaining increased attention due to the increased severity and frequency of wildfires worldwide. Popular fire detection techniques, such as satellite imaging and remote camera-based sensing suffer from late detection and low reliability while early wildfire detection is a key to prevent massive fires. In this article, we propose a novel wildfire detection solution based on unmanned aerial vehicles assisted Internet of Things (UAV-IoT) networks. The main objective is to: 1) study the performance and reliability of the UAV-IoT networks for wildfire detection and 2) present a guideline to optimize the UAV-IoT network to improve fire detection probability under limited system cost budgets. We focus on optimizing the IoT devices' density and the number of UAVs covering the forest area such that a lower bound on the wildfires detection probability is maximized within a limited time and system cost. At any time after the fire ignition, the IoT devices within a limited distance from the fire can detect it. These IoT devices can then report their measurements to nearby UAVs. Discrete-time Markov chain (DTMC) analysis is utilized to compute the fire detection and false-alarm probabilities. Numerical results suggest that given enough system cost, the UAV-IoT-based fire detection can offer a faster and more reliable wildfire detection solution than state-of-the-art satellite imaging techniques.

3	Dai Quoc Trac	Forest-Fire Response System Using Deep-Learning-Based Approaches With CCTV Images and Weather Data	21 Jun 2022	An effective forest-fire response is critical for minimizing the losses caused by forest fires. The purpose of this study is to construct a model for early fire detection and damage area estimation for response systems based on deep learning. First, we implement neural architecture search-based object detection (DetNAS) for searching optimal backbone. Backbone networks play a crucial role in the application of deep learning-based models, as they have a significant impact on the performance of the model. A large-scale fire dataset with approximately 400,000 images is used to train and test object-detection models. Then, the searched light-weight backbone is compared with well-known backbones, such as ResNet, VoVNet, and FBNetV3. In addition, we propose damage area estimation method using Bayesian neural network (BNN), data pertaining to six years of historical forest fire events are employed to estimate the damaged area. Subsequently, a weather API is used to match the recorded events. A BNN model is used as a regression model to estimate the damaged area. Additionally, the trained model is compared with other widely used regression models, such as decision trees and neural networks. The Faster R-CNN with a searched backbone achieves a mean average precision of 27.9 on 40,000 testing images, outperforming existing backbones. Compared with other regression models, the BNN estimates the damage area with less error and increased generalization. Thus, both proposed models demonstrate their robustness

				and suitability for implementation in real-world systems.
4	Lujia Wang	Knowledge-Infused Global-Local Data Fusion for Spatial Predictive Modeling in Precision Medicine	13 May 2021	The automated capability of generating spatial prediction for a variable of interest is desirable in various science and engineering domains. Take precision medicine of cancer as an example, in which the goal is to match patients with treatments based on molecular markers identified in each patient's tumor. A substantial challenge, however, is that the molecular markers can vary significantly at different spatial locations of a tumor. If this spatial

				distribution could be predicted, the precision of cancer treatment could be greatly improved by adapting treatment to the spatial molecular heterogeneity. This is a challenging task because no technology is available to measure the molecular markers at each spatial location within a tumor. Biopsy samples provide direct measurement, but they are scarce/local. Imaging, such as MRI, is global, but it only provides proxy/indirect measurement. Also available are mechanistic models or domain knowledge, which are often approximate or incomplete. This article proposes a novel machine learning framework to fuse the three sources of data/information to generate a spatial prediction, namely, the knowledge-infused global-local (KGL) data fusion model. A novel mathematical formulation is proposed and solved with theoretical study. We present a real-data application of predicting the spatial distribution of tumor cell density (TCD)—an important molecular marker for brain cancer. A total of 82 biopsy samples were acquired from 18 patients with glioblastoma, together with six MRI contrast images from each patient and biological knowledge encoded by a PDE simulator-based mechanistic model called proliferation-invasion (PI). KGL achieved the highest prediction accuracy and minimum prediction uncertainty compared with a variety of competing methods. The result has important implications for providing individualized, spatially optimized treatment for each patient. Note to Practitioners —This article

				proposes a machine learning framework to fuse local data, global imaging, and domain knowledge to generate a spatial prediction for a variable of interest. This methodology is relevant to multiple application domains. In precision medicine, it will allow for mapping the spatial distribution of important, treatment-informing molecular markers across each tumor by integrating biopsy data, MRI, and biological knowledge. This capability can help resolve the spatial heterogeneity of molecular characteristics and greatly improve the precision of cancer treatment. Other applications include early detection of regional fire risk across a forest by integrating ground/aerial survey data, satellite imagery, and fire simulator output, as well as regional poverty estimation for resource allocation.

5	Mohammed Reza Nosouhi	Bushfire Risk Detection Using Internet of Things: An Application Scenario	06 Sep 2021	With rising temperatures and events contributing to climate change, the world is facing extreme weather patterns. Recently, Australia was hit hard by bushfires, the most devastating fires ever faced by the country. The economic damage reported was nearly one billion Australian dollars and an estimated three billion native animals were killed or adversely affected. Given the extent and intensity of this damage, researchers are seeking effective solutions to enable the prediction of fire before it starts to increase the time available for firefighters to protect lives and assets and prepare to mitigate the fires. This motivated us to investigate an approach to address this critical problem. In this article, we propose a machine learning (ML)-based approach that detects anomalies in spatiotemporal measurements of environmental parameters (e.g., temperature, relative humidity, etc.). In the proposed approach, an ML-based model learns the normal spatiotemporal behavior of the environmental data (collected over a period of one year). This is carried out during a one-time training phase. Then, during the detection phase, any spatiotemporal pattern in the real-time data (received from the field sensors) that is different than the normal pattern will be identified by the model as anomaly which indicates a possible bushfire situation. Following this, we propose a supplementary classification model based on Moran's I index to ensure that the detected anomalies are not due to either a sensor failure or a security attack (which are common in Internet of Things).

				We developed three different ML models for performance evaluation and comparison and used the Forest Fire data set to train them. The results of our experiments confirm the effectiveness of the proposed approach in the early detection of fire symptoms.